

FORUM

Keeping Pace With Agriculture's Challenges

Growers today face a daunting list of challenges. Chief among them are dealing with climate change, limiting agriculture's environmental footprint, and expanding the range of key crops to feed growing populations. To address these challenges, we need to look at them in new ways and with new tools.

Agricultural Research Service scientists are at the forefront of these efforts and have been instrumental in developing new technologies that will help both the growers who produce our agricultural bounty and the scientists who look for ways to help address these challenges. This issue of *Agricultural Research* includes articles that describe some of these efforts.

In Raleigh, North Carolina, an ARS agronomist and his colleagues have developed a technique for creating images of cereal crops that is helping scientists understand their internal structures and how they react to cold and other environmental stressors. It involves taking standard slices of plant tissues, making high-resolution digital photos of them, and using imaging software to create a three-dimensional perspective that gives added depth to their structures, above and below ground. The results are similar to images produced by magnetic resonance imaging and computed tomography, but they can be created from much smaller tissue samples, and they are easier and less expensive to produce.

The team used the imaging technique to study ice formation in oat plants. Understanding the effects of ice formation in cereal crops could help breeders develop

hardier varieties with an expanded range. Climate change has also meant some widely fluctuating winter temperatures in recent years, making it important to understand how winter oats and other cereal crops react to frozen soils. The ARS-published work so far in this area has focused on oats, but similar results have been observed in wheat, barley, and rye, and the technique should prove useful for studying a number of other crop plants. You can read about this research on page 4.

Another ARS research team, in the ARS Fruit and Vegetable Insect Research Unit in Wapato, Washington, has found that spotted wing drosophila flies have a taste for certain chemicals present in wines and vinegars. These insect pests from eastern Asia are damaging tree fruit and berry crops across the United States. After extensive testing, the team determined that a precise blend of chemicals is highly attractive to the flies, and that has led to the development of an effective new lure and trap. These kinds of strategies are essential to ensuring a continued supply of nutritious foods while minimizing the use of insecticides. The story begins on page 9 of this issue.

One of the main ways crops are fertilized is with beef manure. It's effective and costs less than commercial fertilizers, but the odor is unpleasant. Two ARS agricultural engineers in Nebraska decided to find out exactly which compounds are responsible for beef manure odor and to evaluate how diet, soil moisture, and application procedures affect the emission of those compounds. They suggest a simple technique that can maintain the benefits

of manure application but greatly reduce the odor. The research was also part of GRACEnet, a wider effort to determine the effects of management practices on soil carbon sequestration, trace gas emissions, and environmental quality. See page 6 for details

When planning a study, such as those mentioned here, researchers consult the scientific literature to see what others have learned about the problem of interest. This can be a time-consuming process, but it can save time and resources in the long run. Many scientific journals are now online, making literature searches much faster. But an ARS ecologist has taken this a step further. He is "geotagging" scientific articles—making them searchable by the geographic location where the research was conducted. You can read about this new search engine on page 19.

Such innovative approaches are a key part of ARS's scientific mission for a simple reason: To address the modern challenges inherent in trying to feed a hungry planet, we have to begin looking at old problems in new ways.

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